Report to the Twenty-Fourth Legislature
State of Hawaii
Regular Session of 2008

KAILUA WATERWAYS

In response to
House Concurrent Resolution 261, House Draft 1
Regular Session 2006

REQUESTING THE DEPARTMENT OF HEALTH,
WITH THE ASSISTANCE OF THE DEPARTMENT OF LAND AND NATURAL RESOURCES AND THE DEPARTMENT OF FACILITY MAINTENANCE OF THE CITY AND COUNTY OF HONOLULU, TO

REPORT TO THE LEGISLATURE ON THE RELATIONSHIP
BETWEEN VARIOUS KAILUA WATERWAYS, INCLUDING THE KAELEPULU POND, AND THE WATER QUALITY AND NATURAL RESOURCES OF KAILUA BEACH AND KAILUA BAY

Prepared by the Environmental Health Administration
Department of Health
State of Hawaii

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REPORT TO THE LEGISLATURE ON THE RELATIONSHIP BETWEEN VARIOUS KAILUA WATERWAYS, INCLUDING THE KAELEPULU POND, AND THE WATER QUALITY AND NATURAL RESOURCES OF KAILUA BEACH AND KAILUA BAY

Executive Summary

The overall impact of the Kaelepulu pond estuary on the water quality and natural resources of Kailua Bay is probably negative. The potential health risks this impact presents to beachgoers are probably low at most locations and times, although these risks are probably higher for swimmers in the estuary water at all times, and especially during and immediately after rainfall events. For ocean swimmers, these risks probably increase as they swim closer to the outflowing estuary water, which only reaches and resides in Kailua Bay less than 5-10% of time (18-36 days per year) before it is thoroughly mixed with surrounding marine waters.

Decreased water quality in the estuary system is a cumulative impact of our land use and water management decisions, infrastructure design and operations, and lifestyle choices over the last century. The information gaps that need to be addressed to clarify existing problems and potential solutions are both technical and institutional. Technically, we need better scientific understanding of pollutant dynamics (sources, transport, and fate) and its relationship with ecosystem consequences across a range of scenarios for managing land, water, and society. Institutionally, we need better social understanding of how to unify our fragmented system of land and water regulation, expand our acceptance of revised engineering and maintenance practices, and soften the environmental impact of human activities.

Many reasonable approaches could be investigated and many potential solutions could be implemented to improve the water quality and natural resources of the estuary system and its impact on state beaches and waters in Kailua Bay. The approaches and solutions we select depend upon the goals we establish for the long-term future of the water environment. Under present conditions, Kaelepulu is filling-in with sediment and will eventually change from a predominantly open water environment to a predominantly wetland environment. Some of the solutions promoted to date imply a goal of slowing or reversing this in-filling. However, this goal has not been clearly established throughout the current network of landowners, public water quality and natural resource trustees, and other public and private interests.

Clear goals for Kaelepulu are obscured by the size and scope of this stakeholder network; the regional context of the surrounding Kailua area (including Lanikai, Kawainui, and Mokapu); and overlapping jurisdictions and competing objectives for land use, water use, environmental quality, and flood management. Therefore, establishing long-term goals and implementing appropriate solutions may best fall under the umbrella of the Hawaii Ocean Resources Management Plan (State Office of Planning). To chart a new course for resource management and help reverse the consequences of our previous actions, this plan adopts an area-based approach implemented by a broad base of stakeholders, rather than sector-based approaches implemented by jurisdictional entities. Elements of this approach that may be particularly useful in Kaelepulu include addressing all resources in an integrated manner that considers cumulative impacts, and adopting regulations that are adapted to area or ecosystem management priorities.

Legislative objectives and physical framework

House Concurrent Resolution 261, House Draft 1 (HCR261 HD1), adopted by the 2006 Legislature, requests the Department of Health (DOH) to submit a report to the Legislature summarizing information from previous reports and studies to reach an understanding of:

(1) The probable impact of the Kaelepulu pond estuary on the water quality and natural resources of Kailua Bay, as well as the potential health risks to beachgoers;

(2) The probable causes of decreased water quality in the estuary system;

(3) Information gaps that need to be addressed to clarify existing problems and potential solutions;

(4) Reasonable approaches that could be investigated to improve the water quality and natural resources of the estuary system and its impact on state beaches and waters in Kailua Bay; and

(5) Potential solutions that could be implemented, with consideration for the mixed ownership and control of various portions of this integrated estuary and ocean system by the state, county, and federal governments and private entities.

The Kaelepulu pond estuary, as part of the *Kaelepulu stream system*[1], is one of many pollutant sources affecting the water quality and natural resources of Kailua Bay. As shown in Figure 1 - Kailua Bay Watershed Areas, other sources that are important to consider include:

1. The remainder of the *Kaelepulu stream system*, including upstream tributaries that drain into Kaelepulu pond (primarily the Kaelepulu stream network that drains the slopes of the Olomana area above the pond) and other estuary segments that drain into Kailua Bay below the pond (the Kaelepulu canal and the Hamakua canal). We call the entire area drained by this system the *Kaelepulu Inland Watershed*. Drainage from this watershed into Kailua Bay is usually blocked by a sandbar at the mouth of Kaelepulu canal. Thus the entire pollutant load from the watershed is trapped in the estuary system until it is partially flushed out during a monthly sandbar clearing operation or large rainfall events.

2. The *Kawainui stream system*, which drains water from Kawainui Marsh through the Kawainui canal estuary into the north end of Kailua Bay near Kapoho Point. This stream system includes three tributary networks that drain into Kawainui Marsh – the Maunawili, Kahanaiki, and Kapaa stream networks. We call the entire area drained by this system the *Kawainui Inland Watershed*.

3. Shoreline lands along Kailua Bay that drain directly into the ocean. We divide this drainage area into three segments - *Lanikai Shoreline Watershed* (from Wailea Point to

[1] Italicized geographic terms are those commonly used by DOH for regulatory and planning purposes. The entire *Kawainui stream system* was tributary to the *Kaelepulu stream system* before Kawainui was diked and rerouted for flood control. An overall view of watershed boundaries, waterbody delineations, and key features referred to throughout this report is shown in Figure 1 - Kailua Bay Watershed Areas.

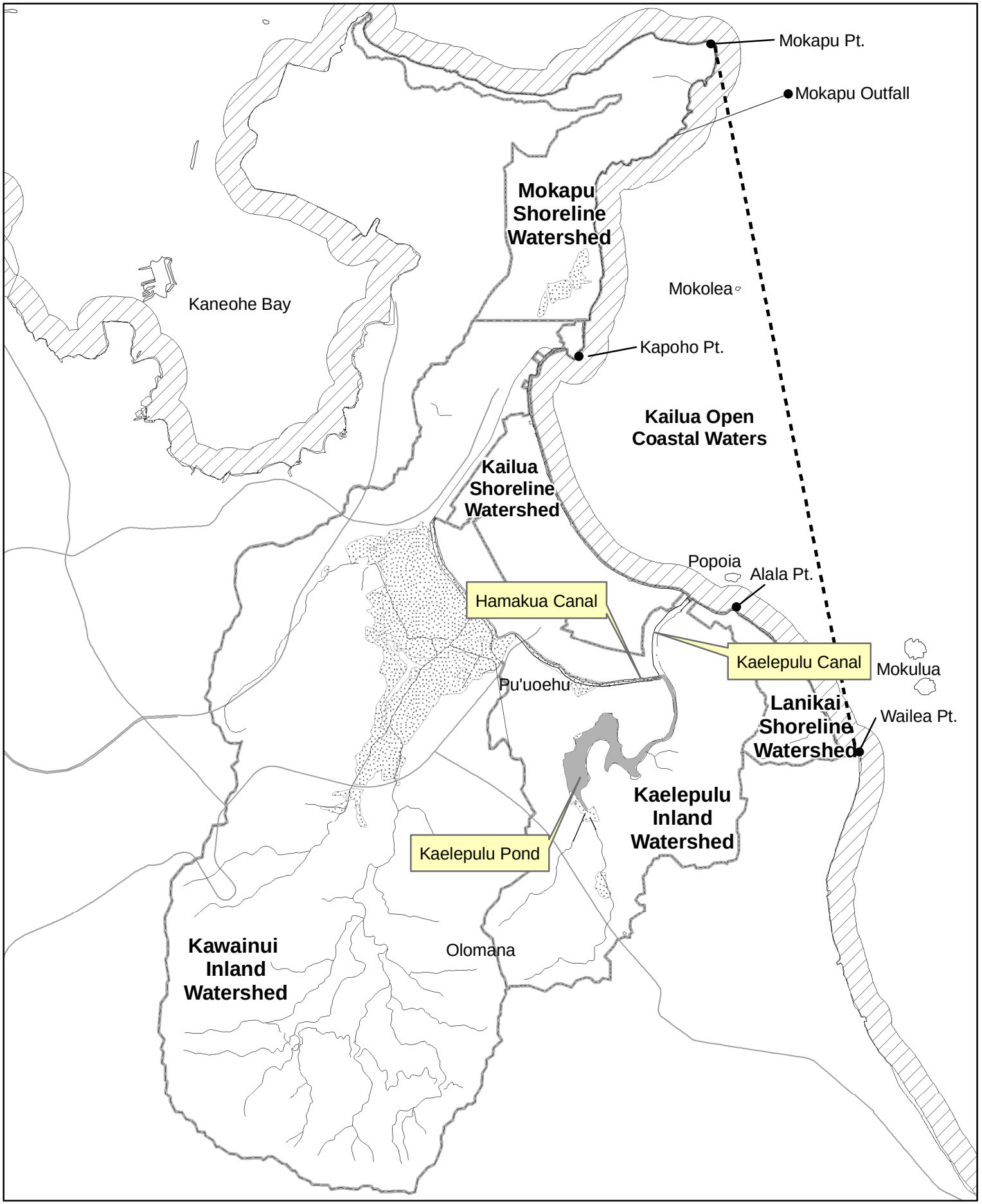

Figure 1
Kailua Bay Watershed Areas

Alala Point), *Kailua Shoreline Watershed* (from Alala Point to Kapoho Point), and *Mokapu Shoreline Watershed* (from Kapoho Point to Mokapu Point).

4. The Kailua Regional Waste Water Treatment Plant (KRWWTP) operated by the City and County of Honolulu (CCH) and the Kaneohe Bay Water Reuse Facility (KBWRF) operated by the U.S. Marine Corps Base Hawaii (MCBH), that discharge treated sewage effluent through a single outfall (Mokapu Outfall) into Pacific Ocean waters surrounding Kailua Bay. Pollutant transport from the Mokapu Outfall is predominantly in a northerly direction away from Kailua Bay, although transport to the reef area near the southern end of Kailua Beach is possible when there is a surfacing effluent plume, a southerly current, and northerly winds.[2]

5. Pacific Ocean waters surrounding Kailua Bay.

Water quality throughout the *Kaelepulu stream system*, the *Kawainui stream system*, and Kailua Bay is potentially affected by one or more of the following pollutant sources [in addition to 4. and 5. above]:

(i) Municipal separate storm sewer systems (MS4) operated by CCH (various departments), the State of Hawaii (various departments), and the U.S.A. (MCBH), which drain most of the urbanized areas of the inland and shoreline watersheds.

(ii) Untreated and pretreated sewage that leaks and spills from KRWWTP and KBWRF collection systems into groundwater and surface water.

(iii) Facilities and activities other than MS4, KRWWTP, and KBWRF that are regulated by National Pollutant Discharge Elimination System (NPDES) permits, Water Quality Certifications (WQC), or other decisions issued by DOH.

(iv) Nonpoint sources of diffuse pollution and polluted runoff such as:
   a. untreated and treated sewage that leaks and spills from cesspools, septic systems, and other individual wastewater systems (IWS) and on-site disposal systems (OSDS) into groundwater and surface water;
   b. stormwater runoff and non-stormwater discharges from conservation, agricultural, and urban lands not connected to an MS4;

[2] Krock, H.-J. & R.S. Fujioka. 1993. Kailua Bay bacteriological water quality and circulation assessment report (KB-6). University of Hawaii Water Resources Research Center Project Report PR-94-09. According to this report, bacteriological water quality conditions in the recreational area adjacent to Kailua Beach are primarily influenced by land-derived discharges and direct recreational usage, and the influence of the Mokapu outfall discharge on this area is insignificant. Since all of the KRWWTP effluent passes through a fine screen before entering the outfall pipe, the discharge cannot be a source of undesirable large-size solid materials found on Kailua Beach (such as prophylactics and fecal material) that likely comes from beach users and their dogs as well as marine turtles. However, floatable material such as oil and grease, if in high enough concentration, is susceptible to direct wind-induced transport from the discharge area to Kailua Beach. Consequently the removal of such floatables should remain a high priority for the treatment process. Similarly, blooms of the green algae *Pyramimonas* are most likely caused by an increase in the mass emission rates of nutrients resulting from urbanization and population growth (humans and other animals) and corresponding decrease in nutrient-absorbing wetland area, rather than by discharges from the Mokapu outfall.

c. the flux of pollutants between stationary/resuspended bottom materials and the water column;
d. the flux of pollutants driven by biological, chemical, and physical processes in the water column;
e. groundwater (usually as a result of human activity in the overlying recharge area);
f. direct deposits of pollutants from animals and human activities;
g. mixing with adjacent tidally-influenced waterbodies; and
h. atmospheric deposition during both dry weather (particles) and wet weather (particles and dissolved pollutants).

Implementation Summary

Regardless of the causes of decreased water quality (Legislative Objective 2), information gaps (Legislative Objective 3), and reasonable approaches (Legislative Objective 4), the potential solutions to water quality problems in the estuary system (Legislative Objective 5), in general, include:

(5)(a) Controlling pollutants at the source by reducing their occurrence and/or preventing their movement away from the source towards the estuary system;

(5)(b) Managing pollutant transport by diverting pollutants away from the estuary system and/or detaining their delivery to the estuary system;

(5)(c) Modifying pollutant fate by treating and removing pollutants as they are transported along surface and groundwater pathways, before they enter the estuary system; and

(5)(d) Treating and removing pollutants that have been deposited in the estuary system.

The objective of most water pollution control and water quality management strategies is to employ tactics that achieve solutions 5(a), 5(b), and 5(c) and thus may preclude the need for solution 5(d). However, when facilities are purposefully designed or unintentionally function to trap pollutants before they reach the next waterbody downstream, implementing solution 5(d) can involve trade-offs between water quality in these two adjacent waterbodies (in this case the estuary system and Kailua Bay). For example, some of the tactics identified in conjunction with solution (5)(d) for Kaelepulu include dredging certain sections of the estuary system; improving estuary circulation and increasing the exchange of water between the estuary system and marine waters (by spot dredging, modifying the monthly sandbar clearing operation, and/or constructing a more permanent engineering solution to opening the estuary mouth for longer periods); and increasing the volume of water entering the upstream ends of the estuary system by adding groundwater from a well and/or adding surface water from the *Kawainui stream system*. Such measures could increase the storage, flushing, and assimilative capacity of the estuary system and could increase the frequency, magnitude, and duration of pollutant loading to Kailua Bay.

The implementation of such solutions implies a common goal of slowing or reversing the in-filling of the estuary system, which will eventually change from a predominantly open water environment to a predominantly wetland environment under current regulation, infrastructure operations, and lifestyle choices. However, this goal has not been clearly established by landowners, public water quality and natural resource trustees, and other public and private interests participating in the management of this highly-modified estuary and ocean system. Given the multiple and potentially conflicting uses of the estuary system; the actual and probable impact of the estuary system on the water quality and natural resources of Kailua Bay, as well as the potential health risks to beachgoers; and the wide range of authorities, policies, plans, rights, responsibilities, and entitlements affecting and affected by our management of the waters and other natural resources involved, it seems that comprehensively clarifying existing problems and potential solutions (Legislative Objective 3), investigating reasonable approaches (Legislative Objective 4), deciding the long-term fate of the integrated estuary and ocean system, and selecting and implementing appropriate solutions (Legislative Objective 5) may best be addressed under the umbrella of the Hawaii Ocean Resources Management Plan (please see online at www.hawaii.gov/dbedt/czm/orm/pdf/2006ormp.pdf).

The Hawaii Ocean Resources Management Plan (ORMP), updated in 2006 by the Office of Planning (OP) in the State of Hawaii Department of Business, Economic Development, and Tourism (DBEDT), recognizes both "the inter-relationship between land and sea, and the need for community and all levels of government to work together collaboratively" and the challenges presented by "Changing practices in multiple federal, state and county agencies, revisiting multiple laws, ordinances and regulations, and modifying habits of community-government interactions ..." In a recent OP Coastal Zone Management (CZM) presentation to the Lanai and Maui Planning Commissions, the ORMP was described as "our first step toward a comprehensive, futuristic plan for the best and wisest uses of the ocean and nearshore areas consistent with the public trust doctrine." Therefore it seems that the ORMP may provide the most appropriate framework available for analyzing how relationships between inland water quality and natural resources and marine water quality and natural resources are best managed to serve a primary goal "to improve and sustain the ecological, cultural, economic, and social benefits we derive from ocean resources today and for future generations."

A key strategy embedded in this plan involves creating "a system of best practices that is based upon the indigenous resource management practices of moku (regional) boundaries, which acknowledges the natural contours of land, the specific resources located within those areas, and the methodology necessary to sustain resources and the community" (see Act 212 of 2007). Building on this foundation, the planning process must also be informed by a wide range of contemporary science and policy, in order to comprehensively evaluate trade-offs among and between water quality goals, other natural resource goals (including federal endangered waterbird conservation), public trust and public use obligations, current zoning and other property entitlements, flood management objectives, and available regulatory and funding mechanisms.

Coordinated legislative, executive, and community action will be needed to conduct this planning process, implement the selected solutions, and achieve the established goals. Key elements of this coordination may include a wide range of existing authorities and functions

within federal, State, and City government, particularly the Hawaii Water Code and Water Plan (State Commission on Water Resource Management); Flood Control, Conservation District Use Regulation, and Forestry and Wildlife Management (State Department of Land and Natural Resources); the CCH Development Plan, Koolaupoko Sustainable Communities Plan, and related municipal approvals, permits, and requirements (especially Special Management Area; Drainage, Flood, and Pollution Control; Grading, Grubbing, and Stockpiling: and Maintenance of Channels); and the Koolaupoko Watershed Restoration Action Strategy and a future Kaelepulu Total Maximum Daily Load Implementation Plan (State Department of Health).

Management/analytical framework

For water quality management purposes, DOH uses a watershed approach that links management responsibilities and analytical tasks with the physical framework of watershed areas (see Legislative objectives and physical framework) and the waterbodies that drain these areas. Using this approach, we divide the Kaelepulu pond estuary into three segments (see Figure 1- Kailua Bay Watershed Areas above)

Kaelepulu pond (Segment 1) collects runoff that is delivered via:

(a) The Kaelepulu stream network, draining the slopes of Olomana and surrounding areas;

(b) Municipal separate storm sewer systems (MS4s) operated by various public entities, that drain urbanized lands; and

(c) Overland flow and direct discharges (such as swimming pool drains and roof downspouts) from adjacent lands.

Kaelepulu canal (Segment 2) leads seaward from Kaelepulu pond and meets the Kailua Bay shoreline at Kailua Beach Park, where a sandbar usually blocks the canal from entering the ocean. Along the way it is joined near the Wanaao Street bridge by the Hamakua Canal (Segment 3), which runs from the southwestern corner of Coconut Grove, along the south side of Kailua Town, and through the northern end of the Enchanted Lake neighborhood. Segments 2 and 3 collect runoff that is delivered via (b) and (c) above. For Segment 3 this includes overland flow from the slopes of Puuoehu above Hamakua Marsh. Groundwater discharge can contribute directly to (a), (b), (c), and each estuary segment. We call the entire area drained by the Kaelepulu stream network and these three estuary segments the *Kaelepulu Inland Watershed*. The three estuary segments mix with marine waters in Kailua Bay via groundwater flux (assumed to be minimal) and episodic breaching of the sandbar.

For water quality management purposes, DOH divides the marine waters of Kailua Bay into numerous segments. "Open coastal waters" in general cover all areas from the shoreline out to 600 feet deep.[3] Thus, for purposes of this report, the area enclosed by drawing a line between

[3] Within these open coastal waters, one or more of six marine bottom types may be present, but their occurrence (both statewide and in Kailua) has not been comprehensively identified or mapped. DOH administrative rules specify "wave exposed reef communities" at Moku Manu as Class 1 "water areas to be protected." Other areas of

Wailea Point (south end of Lanikai) and Mokapu Point (north end of Mokapu) is called "*Kailua open coastal waters*" (maximum depth in this area is less than 100 feet). This area includes two State Seabird Sanctuaries (Popoia Island and Mokolea Rock) and a submerged coral reef at a depth of around 20 ft. Live coral cover along this submerged reef is sparse, mostly concentrated in a few patches at the southern end of the segment, offshore from Lanikai. Immediately outside of this area are two more State Seabird Sanctuaries (Mokulua Islands to the south and Moku Manu to the north) and the Mokapu Outfall serving the KRWWTP and the KBWRF.

Current DOH administrative rules specify water quality criteria for marine recreational waters within one thousand feet of the shoreline. Within this one thousand foot corridor, DOH has delineated five areas along the Kailua Bay shoreline (Lanikai, Kailua, Kalama, Oneawa, and Fort Hase; oaspub.epa.gov/beacon/beacon_county_page.main?p_county_fips=003&p_state_fips=15) where immediate public health risks to recreational users are addressed under the Beach Monitoring & Notification program (www.epa.gov/waterscience/beaches) required by the federal Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH Act). The BEACH Act specifies the less stringent water quality criteria applied for protecting recreational use in marine waters beyond one thousand feet from the shoreline. Although a lot of beachgoer activity within *Kailua open coastal waters* occurs within this one thousand foot wide corridor and its delineated DOH BEACH areas, shoreline waters not delineated as BEACH, and waters beyond one thousand feet from the shoreline, also host considerable swimming, surfing, diving, boating, and fishing activity. For longer-term water quality monitoring and assessment purposes, DOH considers the delineated BEACH areas to be parts of larger areas that make up *Kailua open coastal waters*.

Given that access to the Mokapu peninsula shoreline is restricted by MCBH, and that most of the land-based pollutant loading of *Kailua open coastal waters* occurs via Kawainui canal and Kaelepulu canal (both entering the ocean between Kapoho Point and Alala point, see "*Kailua shoreline recreational waters*" below), marine recreational areas within *Kailua open coastal waters* can be divided as follows for longer-term water quality monitoring and assessment purposes:

(d) The area within one thousand feet of the shoreline from Wailea Point (south) to Alala Point (north), called "*Lanikai shoreline recreational waters*" for purposes of this report.

(e) The area within one thousand feet of the shoreline from Alala Point (south) to Kapoho Point (north), called "*Kailua shoreline recreational waters*" for purposes of this report.

(f) The area within one thousand feet of the shoreline from Kapoho Point (south) to Mokapu Point (north), called "*Mokapu shoreline recreational waters*" for purposes of this report.

(g) The area beyond one thousand feet from the shoreline within *Kailua open coastal waters*, called "*outer Kailua marine recreational waters*" for purposes of this report.

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specific marine bottom type within or near *Kailua open coastal waters* may have been identified and delineated in previous DOH regulatory decisions, but this information was not readily available for use in this report.

Lanikai shoreline recreational waters and *Mokapu shoreline recreational waters* receive land-based water that is delivered via groundwater discharge and (b) and (c) above. We call the contributing areas for this water, respectively, the *Lanikai Shoreline Watershed* and the *Mokapu Shoreline Watershed. Kailua shoreline recreational waters* receive land-based water that is delivered via groundwater discharge and:

- the *Kaelepulu Inland Watershed* (previously described),
- the *Kawainui Inland Watershed* [collects runoff via (b) and (c) above, Kawainui canal, Kawainui Marsh, and the Kapaa, Kahanaiki, and Maunawili stream networks], and
- the *Kailua Shoreline Watershed* [collects runoff via (b) and (c) above, mostly from residential areas of Coconut Grove and Kailua Town].

Along with land-based pollutant loading (from surface water and ground water), the quality of these marine recreational waters is affected by atmospheric deposition of pollutants; the flux of pollutants from stationary and resuspended ocean bottom materials; the flux of pollutants driven by biological, chemical, and physical processes in the water column; direct deposits of pollutants from animals and human activities; and mixing with surrounding ocean waters.

(1) The probable impact of the Kaelepulu pond estuary on the water quality and natural resources of Kailua Bay, as well as the potential health risks to beachgoers

(a) Water quality and natural resources

The overall impact of the Kaelepulu pond estuary on the water quality and natural resources of Kailua Bay is probably negative. However, this is difficult to evaluate since baseline water quality and natural resource information for this area is limited. Based on water quality monitoring conducted at five Kailua Bay shoreline locations from 1999 to 2005, and other historic data, DOH recently determined that water quality is impaired by excessive nutrients and turbidity at Kailua Beach Park and Oneawa Beach (as indicated by "N" and Category "5" in the table below), and that water quality fully supports marine recreational uses at Lanikai Beach, Kailua Beach Park, and Kalama Beach (as indicated by "A" and Category "2" in the table below).

2006 Waterbody Assessment Decisions [Integrated 303(d) List/305(b) Report for Hawaii]
(Excerpt for *Kailua open coastal waters* from DOH 2006 Water Quality Monitoring and Assessment Report)
(Complete report available at www.hawaii.gov/health/epo)

Scope of Assessment	enterococci	Total N	NO3+NO2	Total P	TURB	Other Pollutants	Category	TMDL Priority
Lanikai Beach	A	?	?	?	?		*2,3*	
Kailua Beach Park	A	N	?	N	N	chl-a(N)	*2,3,*5	L
Kalama Beach	A	?	?	?	?		2,3	
Oneawa Beach	?	N	?	N	N	chl-a(N)	*3,*5	L
Fort Hase Beach	?	?	?	?	?		3	

Given the lack of complete monitoring and assessment at these shoreline locations (as indicated by "?" in the table above), uncertainty about the extent to which the 1999-2005 shoreline measurements and other historic data represent water quality conditions throughout *Kailua open coastal waters*, and other factors (including lack of DOH financial resources), DOH determined that water quality impairments at Kailua Beach Park and Oneawa Beach are low priority for initiating TMDL development within the next two years (as indicated by "L" in the table above). However, the TMDL process, which includes calculating the "Total Maximum Daily Load" (TMDL) of pollutants that a waterbody may receive, and allocating this load among the contributing sources, provides one approach for improving our understanding of the overall impact and relative importance of the estuary and other contributing sources (see pages 1 and 2 above) on the water quality and natural resources of Kailua Bay. Additional water quality and natural resource information that could be used or might be needed during this process is discussed below under (3) Information gaps.

Although the low quality of estuary water is well-established [see (1)(b) Health risks and (2) The probable causes of decreased water quality below], its relationship with the water quality and natural resources of Kailua Bay is not. This uncertainty stems from both the aforementioned lack of baseline water quality and natural resource information for Kailua Bay, and a corollary lack of knowledge about the frequency, duration, constituency, and magnitude of pollutant loading from the estuary. All of this is compounded by our poor understanding of how estuary pollutant loading and pollutant loading from all other sources interact within Kailua Bay to produce long-term cumulative impacts on water quality and natural resource conditions.

Preliminary calculations posted by the Enchanted Lake Residents Association (ELRA) at:

- kaelepulupond.com/documents/Jan04StormWaterQuality.pdf
- kaelepulupond.com/documents/WaterQuality_KaelepuluPond_7-06.pdf

suggest that the estuary delivered 7 to 10 tons of sediment to Kailua Bay during one 24-hour storm in 2004 (with a measured TSS concentration of 37 mg/L), and 0.2 to 1.1 tons of sediment per hour to Kailua Bay (totalling 0.6 to 3.2 tons per event) during three storms in 2006 (at an average TSS concentration of about 26 mg/L). The TSS concentrations measured are 30-85% greater than that established as the regulatory "geometric mean not to exceed" value in streams for the storm event period (20 mg/L), but are 26-48% less than the corollary "value not be exceeded more than ten per cent of the time" (50 mg/L).

Although there are no regulatory TSS concentrations or sedimentation/deposition limits established for estuaries and open coastal waters, it is expected that dilution effects will result in lower concentrations as water moves from stream to estuary to ocean, and that oceanographic processes will distribute sedimentation/deposition across a wide area. Therefore, these sediment loading calculations seem to suggest that wet weather flows from the estuary have minimal short-term negative impact on Kailua Bay water quality, and that dry weather flows from the estuary (during the monthly sandbar clearing operation) have even lesser impact (for example, TSS concentrations measured by DOH under dry weather conditions at five estuary locations on four occasions in 2004 ranged from 2 to 19 mg/L and had a geometric mean of 5 mg/L, which is lower than the most stringent regulatory value for streams). However, these conclusions assume

that the sediment is "clean" (no other pollutants attached to the sediment) and is the only pollutant transported by the estuary water. They do not consider the long-term cumulative impact of clean or "dirty" sediment loading or the short-term and long term impact from any other pollutants that may be present in estuary water [see (2) The probable causes of decreased water quality below].

For example, nutrient concentrations in the estuary water delivered to Kailua Bay were measured for the estimated 3.2 ton sediment loading event that occurred in 2006. These concentrations reached levels 2 to 9 times greater than the least stringent (highest concentrations) State regulatory values for estuary waters, and 2 to 13 times greater than those for open coastal waters. This seems to suggest that wet weather flow from the estuary may have greater short-term impact on Kailua Bay water quality than previously concluded. Similarly, DOH measurements of dry weather estuary water quality in 2004 (with geometric means for ammonia nitrogen and total nitrogen that well-exceeded the least stringent State regulatory values, and geometric means for nitrate+nitrite nitrogen and total phosphorous that were 3 to 4 times greater than the most stringent regulatory values), seem to suggest that dry weather flow from the estuary (during the monthly sandbar clearing operation) may also have greater short-term negative impact on Kailua Bay water quality than previously concluded. As with the discussion of sediment loading above, these conclusions do not consider the long-term cumulative impact of nutrient loading; the short-term and long-term impact from any other pollutants that may be present in estuary water [see (2) The probable causes of decreased water quality below]; or how estuary pollutant loading and pollutant loading from all other sources interact within Kailua Bay to produce long-term cumulative impacts on water quality and natural resource conditions.

According to representatives of the CCH Department of Facility Maintenance (DFM), DFM monitors the monthly sandbar clearing operation (that allows estuary water to enter Kailua Bay under dry-weather conditions) by visual observation only, in accordance with practices established under a previously issued federal permit for this activity. DFM would note if very turbid discharge occurred, and is so far unaware of any high turbidity discharge. This may suggest that dry-weather flows from the estuary have minimal short-term negative impact on Kailua Bay water quality. However, except for monitoring aimed at assessing the potential health risks that dry weather flows from the estuary present to beachgoers [see (b) Health risks below], it is uncertain whether any of the other contemporary or historic water quality sampling referred to above occurred in conjunction with dry-weather flows that were released from the estuary into Kailua Bay during the monthly sandbar clearing operation.

Turbidity was recently reported in Kailua Bay when sand cleared from the mouth of Kaelepulu canal by DFM was redistributed by the CCH Department of Parks and Recreation (DPR) for strategic shoreline protection. There are questions about which regulatory permits, certifications, and verifications are required for these activities [such as those processed by the U.S. Department of the Army, the State Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL), and DOH] and whether CCH has obtained the necessary regulatory approvals. Portions of this regulatory framework include monitoring requirements that would provide data to help evaluate the short-term impacts of sandbar clearing and sand redistribution on adjacent marine water quality and natural resources. The current lack

of such data increases the difficulty and uncertainty of assessing the impact of these activities upon water quality and natural resource conditions in Kailua Bay.

A systematic accounting of pollutant loading from all sources, combined with an analysis of the transport and fate of these pollutants in Kailua Bay, provides one approach for improving our understanding of the probable impact of the Kaelepulu pond estuary on the water quality and natural resources of Kailua Bay. Pursuit of this approach (including the TMDL process for the Kaelepulu estuary system) is discussed throughout the remainder of this report.

(b) Health risks to beachgoers

The potential health risks that estuary water quality presents to beachgoers are probably low at most locations and times, although these risks are probably higher for swimmers in the estuary water at all times, and especially during and immediately after rainfall events (and under other conditions of lower salinity) at all locations. For ocean swimmers, these risks probably increase as they swim closer to the outflowing estuary water, which only reaches and resides in Kailua Bay less than 5-10% of time (18-36 days per year) before it is thoroughly mixed with surrounding marine waters. The greatest potential health risks presented by estuary water may be associated with the possible presence of vibriosis in surrounding marine waters (which may be related to the concentration of organic material in the water) and of leptospirosis in wet-weather flows, mud, and moist soil.[4] Beachgoers could be exposed to leptospirosis when eyes, nose, mouth and open cuts or wounds come into contact with estuary flows, floodwaters, and flood-borne sediment.

The risk of exposure to human sewage, which may carry other diseases and other harmful pollutants, is also greatest during and immediately after rainfall events, when plumbing, cesspools, septic tanks, sewer lines, and sewer manholes are more likely to overflow and/or leak. During extreme rainfall events, DOH has issued a "Brown Water Advisory" that flood waters

[4] See www.hawaii.gov/health/family-child-health/contagious-disease/comm-disease/factsheet/cddvibri.htm, www.hawaii.gov/health/family-child-health/contagious-disease/comm-disease/factsheet/leptospirosis.pdf, and www.hawaii.gov/health/about/reports/leptobrochure.pdf for vibriosis and leptospirosis information. The survivability of leptospirosis seems to decline as its environment becomes saltier (it survives for less than a day in seawater), more acidic, and warmer. According to the DOH Disease Outbreak and Control Division (DOCD), from 1990 through 2006 there have been 18 probable leptospirosis exposures associated with the Kailua Bay watersheds. These include 1 at the Kalama Beach Park/canal/Kaelepulu and 17 cases from Maunawili Falls/Stream. Some cases do not have a probable exposure site reported or cannot be reached for an interview so there could be cases with exposure in other areas that DOCD is not aware of. Other bacterial diseases and parasitic diseases spread by animals may also be present in these waters, including but not limited to:

- Staph infections (also present in marine waters, concentration is related to concentration of people in water) www.hawaii.gov/health/family-child-health/contagious-disease/comm-disease/factsheet/mrsa.pdf
- Schistosome dermatitis (swimmer's itch, also present in marine waters) www.hawaii.gov/health/family-child-health/contagious-disease/comm-disease/factsheet/cddswimm.htm
- Cryptosporidiosis (limited survivability in marine waters, decreases with duration of exposure) www.hawaii.gov/health/family-child-health/contagious-disease/comm-disease/factsheet/cryptosporidiosis.pdf
- Giardiasis (limited survivability in marine waters, decreases with duration of exposure) www.hawaii.gov/health/family-child-health/contagious-disease/comm-disease/factsheet/giardia.pdf

Additional information about these and other diseases is available at:

- www.cdc.gov/ncidod/dbmd/diseaseinfo/default.htm
- 0-www.cdc.gov.mill1.sjlibrary.org/ncidod/dpd/parasites

may contain pollutants from overflowing cesspools, septic systems, sewer manholes, animal wastes, chemicals from herbicides/pesticides, and associated flood debris, and animal droppings. In these cases, the public is advised to stay out of coastal waters impacted by storm water (brown water) runoff. The most recent Brown Water Advisories affecting Kaelepulu estuary and Kailua Bay were an advisory for northern Kailua Bay issued for the period November 09-12, 2007; an Oahu advisory issued for the period November 04-09, 2007; and statewide advisories issued for the period November 01-06, 2006 and on December 5, 2007.

Sewage spills can also occur during dry weather due to various failures in the sewer collection system. DOH and the counties post warning signs by waters known to have been contaminated by wet-weather or dry-weather sewage spills. Rain advisories, contamination advisories, and other water quality-related public health warnings, advisories, and closures are also posted on DOH and EPA websites at:

- emdweb.doh.hawaii.gov/CleanWaterBranch/CurrentWarnings/default.aspx
- oaspub.epa.gov/beacon/beacon_state_page.main?p_state_fips=15

The most recent sewage spills reported in the estuary-ocean system occurred on November 04, 2007, with the public advised to stay out of Kaelepulu Stream. Previous spills occurred at various locations in February, March, and November 2004 and February-April 2006, including a contamination advisory affecting 2.9 miles of Kailua Beach for 24 days in March-April 2006 and another affecting 1.2 miles of Kailua Beach for 7 days in February-March 2006.

As part of a multiple line of evidence approach to identifying risk of exposure to human sewage, DOH, CCH,[5] and other parties also test recreational waters for fecal indicator bacteria (FIB) under ambient conditions (dry- and wet-weather) and in response to sewage spills (www.hawaii.gov/health/environmental/water/cleanwater/spill_monitoring.html). High FIB test results by themselves do not necessarily mean that human sewage is present, and test results do not by themselves lead to posting of warning signs. DOH reviews other factors including turbidity, ocean current flow, salinity, weather conditions, visual indicators and water body history to determine when signs may be posted or taken down. The most recent DOH High Indicator Bacteria Count (HIBC) advisory affecting Kailua Bay was posted at Kailua Beach from November 28 to December 07, 2005. More information about FIB testing and related risk factors is available at www.hawaii.gov/health/about/reports/bacteriatestingquestions.pdf.

DOH also uses FIB test results to assess long-term recreational ambient water quality and the degree to which it supports recreational water uses. As noted in section (1)(a) above, DOH determined that water quality fully supports marine recreational uses at Lanikai Beach, Kailua Beach Park, and Kalama Beach for the 2001-2005 monitoring and assessment period. However, additional water quality monitoring data, such as the aforementioned CCH compliance data and the results of a 2004 Windward Community College (WCC) monitoring project led by Dr. Leticia Colmenares, appear not to have been considered in these assessment decisions. For example, the WCC data suggest exceedances of FIB criteria at Oneawa Beach and Kailua Beach

[5] A map of CCH sampling locations shows where FIB monitoring is conducted for compliance with Kailua WWTP permit conditions (www.honolulu.gov/env/mokapsta.gif). This compliance data, along with information about recent CCH advisories and spills, was not readily available for use in this report.

(www.wcc.hawaii.edu/water/Windward%20Beaches/windwardbeaches01.htm) that should be considered for the 2008 DOH water quality assessment decision cycle.

To make these assessment decisions, we compare FIB test results with State recreational standards (geometric mean criterion for enterococci is 7 CFU/100 ml in marine waters and 33 CFU/100 ml in inland waters), based on an assumption that the State marine criterion is associated with about 9 cases of minor gastrointestinal illness per thousand swimmers. Thus, theoretically, the higher the test results go above the State criterion, the greater the risk of swimmers experiencing minor gastrointestinal illness. For example, the less stringent national recreational standard (geometric mean criterion) for marine waters (35 CFU/100 ml) is based on an assumption that it is associated with 19 cases per thousand swimmers.

In addition to the shoreline locations in Kailua Bay discussed above, DOH monitored inland waters at the Kaelepulu estuary mouth from 1999 to 2005. Based on these measurements, other historic data, and the 2004 DOH measurements of dry weather estuary water quality mentioned above, DOH determined that absent additional information, water quality throughout the stream system is impaired by excessive nutrients and turbidity (as indicated by "N" and Category "5" in the table below), and does not fully support inland recreational uses (but does not necessarily pose potential or immediate public health risks to beachgoers) due to excessive, point-specific FIB counts as indicated by "N" under enterococci and Category "5" in the table below. In 2002, DOH determined that these water quality impairments were high priority for initiating TMDL development within the next two years (as indicated by "H" in the table below), and began the TMDL development process (in progress as indicated by "IP" in the table below) in 2004. As discussed in section (1)(a) above, the TMDL process, which includes calculating the "Total Maximum Daily Load" (TMDL) of pollutants that a waterbody may receive (including FIB) and allocating this load among the contributing sources, provides one approach for improving our understanding of the overall impact and relative importance of the estuary and other contributing sources (see pages 1 and 2 above) on the support of recreational water uses and of the potential health risks that estuary water quality presents to beachgoers. Additional information that could be used or might be needed during this process is discussed below under (3) Information gaps.

2006 Waterbody Assessment Decisions [Integrated 303(d) List/305(b) Report for Hawaii]
(Excerpt for Kaelepulu canal from DOH 2006 Water Quality Monitoring and Assessment Report)
(Complete report available at www.hawaii.gov/health/epo)

Scope of Assessment	enterococci	Total N	NO3+NO2	Total P	TURB	Other Pollutants	Category	TMDL Priority
Kaelepulu Stream – Kailua Bch	N	N	?	N	N	chl-a(N)	*3,*5	*H* (IP)

From 1990 to 1991, the University of Hawaii Water Resources Research Center (WRRC) conducted 28 water quality sampling events at a shoreline location in front of the estuary mouth. According to WRRC (www.wrrc.hawaii.edu/image/Rollposter.gif), during periods when the estuary mouth was blocked, "the quality of water at Kailua Beach was good and met the State recreational standard of 7 enterococci/100 ml." During the periods when the estuary mouth was

open, “the quality of water at the beach was poorer, with enterococci counts often exceeding the state standard of 7 enterococci/100ml. Thus, Kaelepulu Stream is a source of sewage indicator bacteria and has an impact on the quality of water at Kailua Beach.”

Without reviewing the actual data from these sampling events (including corollary data from other shoreline locations and from inside the estuary mouth when it was open), it is difficult to evaluate these WRRC conclusions and assess the potential health risks to beachgoers. However, the DFM sampled water quality at three shoreline locations on each of two days in April 2003, in conjunction with opening the estuary mouth. All six of the measurements obtained were lower than the national geometric mean criterion, and three of the measurements were also lower than the State geometric mean criterion. This seems to suggest that under dry-weather conditions during this particular sandbar clearing event, estuary water quality presented minimal potential health risks to beachgoers. More recently, the use of sand cleared from the estuary mouth for beach nourishment has raised concerns about the quality of this sand and its impact on marine waters. The complete results of associated monitoring, which began in October 2007, were not readily available for use in this report.

According to WRRC, under rainy conditions the concentrations of indicator bacteria in the estuary system increased by 100 to 1,000 fold. However, even during dry weather periods, FIB counts vary widely. For example, geometric means for eight locations sampled about twenty-seven times each by WRRC in 1990-1991 ranged from 76.7 to 2,326.0 CFU/100 ml. In repeat sampling of these locations by WRRC on April 19, 2005, only one measurement exceeded the State inland recreational standard geometric mean criterion of 33 CFU/100 ml. When DOH sampled five locations in the estuary on four occasions in 2004, only three of the twenty measurements obtained were below the State geometric mean criterion and seven were below the State single sample maximum criterion of 89 CFU/100 ml. These twenty measurements ranged in value from 9 to 4,900 CFU/100ml, with a geometric mean of 252 CFU/100ml.

In the most extensive survey of conducted of FIB distribution throughout the estuary, DOH sampled eighty locations on three occasions in 2006. The results suggest the existence of FIB “hotspots” in areas associated with wetlands, animals, stormwater outfalls, and/or poor water circulation and low oxygen levels. These hotspots seem to coincide with previous WRRC and DOH sampling locations and conclusions, and reflect point-specific rather than ambient or regional water quality concerns.

Enterococci in the Kaelepulu Estuary System, 2006
CFU/100 ml, with nondetects (x<10) assigned a value of 5

Waterbody and number of sampling locations	Number of samples (n)	Geomean	values < 33 CFU (geomean criterion)	values < 89 CFU (single sample criterion)
Kaelepulu pond (40)	120	18	69%	86%
Hamakua canal (11)	33	49	42%	70%
Kaelepulu canal (29)	86	15	81%	93%
Total - Kaelepulu Estuary System (80)	279	10	68%	85%

Surveyed FIB levels were generally higher in the Hamakua canal segment of the estuary system than in the Kaelepulu pond or Kaelepulu canal segments. Overall, given the inaccuracy of the FIB criteria as a measure of bacterial threats to human health, it may be inappropriate to conclude that recreational and other designated uses of these waters are impaired as a result of point-specific enterococci exceedances. In fact, the survey results seem to suggest that some or all of these three Kaelepulu segments usually attain the inland recreational water quality criteria and support recreational uses as indicated by spatiotemporal averaging of FIB test results. Overall, as noted by Krock & Fujioka (op. cit., see footnote 4), the practical result of FIB test findings is that efforts to improve the bacteriological conditions in shoreline recreational waters should be directed to discharges from the inland watersheds if they are to be effective.

(2) The probable causes of decreased water quality in the estuary system

Other aspects of Kaelepulu water quality have been presented by the Kailua Bay Advisory Council's (KBAC) 2007 Koolaupoko Watershed Restoration Action Strategy and 2003 Draft Kailua Waterways Improvement Plan (www.kbac-hi.org/ttech/kwip_draft.pdf), ELRA (www.kaelepulupond.org/environment), and DOH (Kaelepulu TMDL workplans and scoping documents). In summary, sampling at five locations by Windward Community College (www.wcc.hawaii.edu/water/Enchanted_Lakes_Data/EnchantedLakesMain.htm) seems to confirm water quality impairment by excess nitrogen, phosphorous, and turbidity, and also suggests excessive lead concentrations. DOH analysis of KBAC-sponsored assessment of chemical contamination (www.kbac-hi.org/Contractors/contractor_photos/HIMB/final.pdf) "indicates that the pesticide levels measured in the Enchanted Lake area appeared to be consistent with Oahu's urban background. The organo chlorine pesticides and total PCBs may be present at levels that could pose a health risk if fish are consumed frequently from Enchanted Lake." Also, "the elevated levels of hexachlorobenzene [www.atsdr.cdc.gov/tfacts90.pdf] in sediment from Site 5 may indicate an ongoing source of contamination at an upgradient location" (letter of 04/10/2006 from DOH Hazard Evaluation and Emergency Response Office to KBAC).

The entire Kaelepulu estuary system serves as a detention and retention facility for pollutants that are washing off and flowing through the adjacent lands. The short, steep, and developed nature of the watershed surfaces means that these pollutants move quickly and powerfully towards their destination, leaving little room, little time, and big challenges for holding them back. Once these pollutants sink into the receiving waters and begin causing water quality problems, these problems are compounded by low freshwater inflows, high groundwater tables, and poor circulation in the estuary system. Thus during recent times this system has a disturbing history of sedimentation, eutrophication, sewage spills, algal blooms, fish kills, odors, invasive plants and animals, and trash and debris. When the system is flushed for short periods (during storm events and periodic mechanized sandbar clearing by DFM), stagnant water with high pollutant concentrations enters the ocean at Kailua Beach.

Estuary water levels decline in response to these openings, climatic conditions, and groundwater tidal dynamics. When water levels decline anaerobic mud flats are exposed and odor complaints are common. When water levels rise, so does the potential for unexpected pollutant loading at

Kailua beach. Odor complaints also tend to recur seasonally, possibly in conjunction with climatic, nutrient, and/or bacterial forcing of sulfur fluxes.

In summary, the most significant probable causes of decreased water quality in the estuary system are:

(i) Municipal separate storm sewer systems (MS4) operated by CCH and the State of Hawaii (various departments) that convey polluted runoff from a variety of land surfaces and human activities. In addition to sediment (see below), this runoff includes rain-induced wash-off from roads, parking lots, rooftops, and lawns, and other urbanized areas, as well as illicit non-stormwater discharges from car washing and other residential and commercial cleaning activities. Waste dumped into storm drains is also carried to the estuary by MS4 flows. While MS4 operations are governed by DOH permit conditions, MS4 operators regulate the quality of stormwater delivered by connecting systems and take enforcement action against illicit dischargers and waste dumpers.[6]

(ii) Untreated and pretreated sewage that leaks and spills from KRWWTP collection systems into groundwater and surface water [see spill discussion under (b) Health risks above]. Wet-weather spills are usually caused by infiltration and inflow (I&I) of stormwater into the collection systems. Causes of I&I include damaged, leaking sewer lines; illegal rain gutter connections; illegal drain/sewer connections; and missing, damaged, or exposed sewer clean-outs[7]. Dry-weather spills (generally caused by blocked sewer lines and/or mechanical failures) are less common, whereas dry-weather leaks in damaged sewer lines may be pervasive throughout the system. In the Kailua area, ground subsidence has been a major cause of damaged lines and major reconstruction and repairs have been ongoing.

(iii)

[6] Monitoring of MS4 discharges to the estuary system is not currently required by DOH nor practiced by the permitees. Other DOH enforcement records for these systems (inspections and violations) were not thoroughly reviewed for this report, although the State Department of Transportation (DOT) Highways Division MS4 was included in a recent major enforcement action against DOT operations statewide. An initial search of DOH electronic records of complaints received from 1999-2007 turned up eight reports of potential problems in the CCH MS4 (draining to the Kaelepulu system) that were referred to CCH by DOH. CCH provided investigative reports documenting their follow-up on four of these referrals, which resulted in one letter of warning about a restaurant discharging grease trap water into the street, one letter of warning about a car leaking oil onto the street, one memo to the Board of Water Supply (BWS) about hosing dirt into a storm drain, and one letter of warning about soil blocking a drainage easement. DOT provided a site investigation sheet documenting their response to a 2005 complaint about sediment deposition delivered to Kaelepulu pond via a drainage culvert beneath Kalanianaole Highway. DOT tracked the sediment source to five properties conducting CCH-regulated grading. CCH reported back (by telephone) 17 months later that any potential discharge of pollutants to the State MS4 from these properties had been eliminated and the culvert is kept free of silt and debris. Complete DOH, CCH, and DOT records of all complaints and enforcement activity were not readily available for use in this report.

[7] DOH has identified approximately 5,676 connections to the CCH sewer collection system in the *Kaelepulu inland watershed*. CCH smoke testing of lines in the Kailua area in 2004 and 2005 revealed 7 damaged, leaking lines; 7 illegal rain gutter connections; 5 illegal drain/sewer connections, and 14 missing/damaged/exposed cleanouts. After mailing informational/instructional letters about these problems, CCH follow-up determined that appropriate repairs were completed. Complete CCH records of sewer leaks and spills potentially affecting the estuary system were not readily available for used in this report. CCH ceased a previous unpermitted discharge of sewage to the estuary system after a DOH enforcement order in 1989.

(iv) Facilities and activities other than MS4s and KRWWTP that are regulated by other NPDES permits or WQC issued by DOH. This includes discharges of storm water associated with industrial activity and with construction activity that disturbs more than one acre of land.[8]

(v) Nonpoint sources of diffuse pollution and polluted runoff such as:

a. untreated and treated sewage that leaks and spills from cesspools, septic tanks, and other IWS and OSDS into groundwater and surface water;[9]
b. stormwater runoff and non-stormwater discharges (e.g. swimming pool drainage) from urban, agricultural, and conservation areas not connected to an MS4;[10]
c. the flux of pollutants between deposited/resuspended bottom materials and the water column;
d. the flux of pollutants driven by biological, chemical, and physical processes in the water column;
e. groundwater (usually as a result of human activity in the overlying recharge area);
f. direct deposits of pollutants from animals and human activities;
g. mixing with adjacent tidally-influenced waterbodies; and
h. Atmospheric deposition during both dry weather (particles) and wet weather (particles and dissolved pollutants).

Except for FIB (see (1)(b) Health Risks above), pollutant concentrations and other water quality conditions have not been systematically measured throughout the estuary system, and pollutant loading from various sources has not been rigorously analyzed. According to a 2006 report posted on the ELRA website, volunteer observations and measurements suggest that "the Keolu Hills Storm Basin constructed by Lone-Star Construction in the 1970's is by far the largest contributor of sediment to the pond;" "drainages entering this basin from the Mt. Olomana side appear to have a much higher sediment concentration as compared to the drains coming in from the more urban Keolu Hills areas;" and "The third highest source of sediment appears to be the canal adjacent to the Kaelepulu School that drains steep undeveloped lands around Kailua High School." Objectives of the current DOH TMDL process for the *Kaelepulu stream system* [see additional discussion of this process in sections (3), (4), and (5) below] include systematic accounting of sediment, nutrient, and bacterial pollutant loading from all sources, combined with analyzing the transport and fate of these pollutants in the estuary system and its relationship with water quality standards and ecosystem consequences. However, this process is not a magic bullet for solving all of Kaelepulu's water resource management problems. Given DOH resource limitations, the TMDL process is not necessarily inclusive of other pollutants and management

[8] Complete information about the number, scope, and compliance status of such permits and certifications issued by DOH and about non-complying facilities and activities was not readily available for use in this report. Unauthorized discharge of construction dewatering effluent and unauthorized fill of wetlands in the Hamakua area for use as a construction baseyard are two of the more recent violations pursued by DOH Enforcement.

[9] DOH has identified 17 approved and inspected wastewater disposal systems within the *Kaelepulu inland watershed*, 10 unapproved and/or uninspected systems, and 62 parcels whose disposal system status is unknown.

[10] An initial search of DOH electronic records of complaints received from 1999-2007 turned up four confirmations of actual discharges to the estuary system, including chlorinated water, herbicides, latex paint, and soapy washwater. Complete DOH records of all complaints and enforcement activity were not readily available for use in this report.

issues that may be a concern in these waters (e.g. flood control), since the minimum legal requirement under federal regulations pertains only to pollutant-waterbody combinations as they appear on the State's Clean Water Act §303(d) List of Impaired Waters.

According to the same 2006 report posted by ELRA, "Part of the community development agreement between the City and ELRA allows these stormwater outfalls to the pond, using the pond as a flood control basin," resulting in shoaling near large storm drain outfalls. Also, "Once plentiful oyster beds are much depleted, but not as a result of harvesting." In this regard, it is important to note that:

(vi) The terms of the community development agreement regarding ongoing management of stormwater discharges and the flood control basin have not yet been reviewed by DOH;

(vii) DOH is unaware of any similar agreements between CCH, DOT, or other NPDES MS4 permittees and other properties connected with or otherwise impacted by stormwater outfalls or other stormwater management features (particularly the Keolu Hills Storm Basin and the Kaelepulu Wetland);

(viii) Unlike for streams, there are no DOH water quality criteria for estuaries that directly regulate the measurable thickness of episodic deposits of flood-borne soil sediments over soft bottoms or the grain size distribution of the these sediments, or that explicitly provide for considering relative changes in estuary bottom biological communities.[11]

(vii) The use of State waters in the *Kaelepulu stream system* for stormwater management and flood control purposes is neither expressly protected nor explicitly prohibited by the State water quality standards.[12]

[11] However, the basic (narrative) water quality criterion that "All waters shall be free of substances attributable to domestic, industrial, or other controllable sources of pollutants" provides six examples of such substances that may be applicable to stormwater discharges to the estuary system [Hawaii Administrative Rules (HAR) §11-54-4(a)].

[12] Regardless of the waterbody type assigned to these waters [HAR §11-54-1], the objective of Class 2 inland waters (including Kaelepulu pond, Kaelepulu canal, and portions of Hamakua canal) "is to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping, and navigation. The uses to be protected in this class of waters are all uses compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class" [HAR §11-54-3(b)(2)]. However, the choice of waterbody type assigned to these and other portions of the estuary system (e.g. "estuary" v. "coastal wetlands" v. "pond" v. "canal" v. "lake") may influence the type of aquatic life and recreation protected and the applicable numeric water quality criteria. For example, oyster beds and full contact recreation (swimming) may be more appropriate uses of a predominantly open water estuary than of a predominantly wetland area. Similarly, "plentiful oyster beds" in a predominantly open water estuary may be somewhat incompatible with swimming and boating in the same water. Also, the protection of some uses in a Class 2 segment may not be compatible with the protection of other uses in an adjacent Class 1 segment (e.g. Class 1 inland waters in Hamakua Marsh, see (5) Potential solutions below), and the removal of sediment accumulated around large storm drain outfalls may conflict with the use of these areas by threatened and endangered waterbirds. Finally, the lack of numeric water quality criteria for types other than "estuary," along with the application of the narrative criterion, may allow the TMDL process to establish "numeric targets" for regulatory purposes that are different from the numeric water quality criteria for estuaries in HAR §11-54-5.2(d)(1).

(ix) The extent of the service areas and conveyance systems regulated by NPDES MS4 permits (including the Kaelepulu pond, Kaelepulu canal, and Hamakua canal themselves); the extent of the non-MS4 drainage service areas and conveyance systems allowed to connect with the MS4s; the extent of cross-connectivity between MS4s; and the extent of the co-mingling of MS4-regulated stormwater and other polluted runoff within MS4 conveyance systems, is all uncertain.

(ix) The authority by which ELRA regulates public access to and enjoyment of State waters within Kaelepulu pond and Kaelepulu canal that overlie lands owned by ELRA is uncertain.

(3) Information gaps that need to be addressed to clarify existing problems and potential solutions

(a) Within the greater Kailua Bay watershed area (two inland watersheds and three shoreline watersheds, see Legislative objectives and physical framework above):

1. Identify marine bottom types, marine resource conditions, pollutant assimilative capacities, and current and potential water quality and ecosystem consequences of pollutant loading throughout Kailua Bay.

2. Calculate KRWWTP and KBWRF pollutant loading rates and load reduction capability for sewage treatment processes (effluent discharge into Kailua Bay) and sewage collection systems (leaks and spills in each Kailua Bay watershed area).

3. Calculate pollutant loading rates and load reduction capability for other regulated facilities and activities (point sources of pollution) and nonpoint sources of diffuse pollution and polluted runoff in each Kailua Bay watershed area.[13]

4. Evaluate alternatives for and consequences of modifying the Kawainui Marsh hydrologic system in order to deliver water to the Kaelepulu estuary system. Controlled release of runoff stored within Kapaa Quarry has been identified as one potential source of water, passing water through the dike between the Marsh and Hamakua as one potential delivery mechanism. Potential consequences include marsh ecosystem effects; changes in pollutant transport, fate, and loading throughout the watersheds; and alteration of the Kawainui Marsh flood control scheme and of flood hydrology throughout the watersheds.

[13] For example, this could include keeping records on the mass and volume of debris collected in MS4s, and using work order systems that document drainage, sewage, and water quality complaints and trouble calls and the resources that were used in addressing the problem. Both CCH and DOT are currently developing this kind of asset management capability.

(b) Within the *Kaelepulu Inland Watershed* (information gaps being partially or wholly addressed in the DOH TMDL process are shown in *italics*):

1. *Obtain compliance and spill-related CCH and DOH water quality monitoring data.*

2. *Evaluate condition, pollutant loading rates, and load reduction capability (including sewer hook-up) for cesspools, septic tanks, and other IWS and OSDS.*

3. *Identify compliance of cesspools, septic tanks, and other IWS and OSDS with regulatory requirements (design approval, system inspection, system maintenance, and variances).*

4. *Determine as-built and as-is storage capacity of Keolu Hills Storm Basin, Kaelepulu pond, Hamakua canal, Kaelepulu canal, and other sediment detention/retention features.*

5. Test the toxicity of sediment presently deposited in these sediment detention/retention features and in areas of shoaling near large storm drain outfalls (where dredging has been proposed).

6. Identify potential sources of hexachlorobenzene contamination found in fish tissue from Kaelepulu pond (contact State Department of Agriculture for information).

7. Identify types of fish commonly consumed from waters in the estuary system.

8. Conduct additional fish and crab tissue sampling to confirm the results of preliminary sampling reported by KBAC.

9. *Calculate pollutant loading capacities (TMDLs) for sediment, nutrients, and bacterial indicators throughout the estuary system, including dilution calculations that account for exchanges and mixing of estuary and marine waters, based on numeric targets selected for these waterbodies in the TMDL process.*

10. *Identify sources of excessive FIB measured at FIB "hotspots" in the estuary system.*

11. *Assign allocations of sediment, nutrient, and bacterial pollutant loading capacities (TMDLs) to NPDES permits and nonpoint sources throughout the Kaelepulu Inland Watershed.*

12. *Calculate reductions in existing pollutant loading needed to implement the allocations established in 13. above.*

13. *Identify feasible approaches for achieving the reductions in existing pollutant loading established in 14. above.*

14. *Evaluate potential consequences of changing DOH regulation of Kaelepulu water quality in one or more of the following ways (HAR §11-54):*
    (a) issuing variances that permit non-attainment of the water quality standards,
    (b) establishing site-specific water quality standards that are more appropriate for protecting the biological, chemical, and physical integrity of the estuary system, and

(c) redefining the estuary system as other waterbody types (such as pond, canal, lake, and wetland) so that numeric water quality criteria for estuaries do not apply and more suitable numeric water quality targets can be established during the TMDL process.

15. Evaluate the applicability and enforceability of CCH Ordinance 41-26 (Maintenance of Channels, Streambeds, and Drainageways) throughout the estuary system, and any potential recourse against the City or private owners of Kaelepulu pond and other stream and estuary segments for failure to maintain suitable conditions to carry off stormwater, prevent flooding, and ensure that the natural flow of water runs unimpaired, and for the removal of any debris, vegetation, silt, or other items or material of any nature which is likely to create an unsanitary condition, blockage, or otherwise become a public nuisance to the health, safety, and welfare of the residents of the city.

16. Evaluate the applicability and enforceability of HRS 46-11.5 (Maintenance of Channels, Streambeds, and Drainageways) throughout the estuary system, and any potential recourse against the State, the City, or private owners for failure to maintain suitable conditions to carry off storm waters and remove debris that is likely to create an unsanitary condition or otherwise become a public nuisance.

17. Identify or formulate DLNR DOFAW Management Guidelines and management plans for Mt. Olomana State Monument (wwww.state.hi.us/dlnr/dofaw/guidelines/mg_jw03/index.html).

18. Analyze the current flooding dynamics of the *Kaelepulu inland watershed* and the *Kailua shoreline watershed* and evaluate the potential impacts of changing these dynamics through

    dredging, dry-weather flow augmentation, and modification of the sandbar clearing operation at the mouth of the estuary system.

19. Assess and evaluate the concerns raised above in <u>(2) The probable causes of decreased water quality</u>, sections (v), (vi), (viii) and (ix).

20. Evaluate the applicability of DLNR Conservation District regulations to potential water quality improvement and flood management activities within the estuary system, and investigate the potential for expanding the ability of conservation district management to prescribe water-quality protective management measures for conservation lands, permitted uses, and non-conforming uses.

<u>(4) Reasonable approaches that could be investigated to improve the water quality and natural resources of the estuary system and its impact on state beaches and waters in Kailua Bay</u>

1. Continue trash and debris clean-up efforts such as those conducted by ELRA and CCH Adopt-A-Stream and Adopt-A-Block programs (www.honolulu.gov/dfm/cleanstream.pdf).

2. Intensify urban stormwater management activities, including CCH street sweeping (which is currently performed "as needed"),[14] maintenance of the storm drain system (which currently is typically in response to a complaint of a clogged drain or visual inspection that reveals substantial trash in the drainage facility), and the clean up of catch basins, manholes and drain lines (typically performed manually or by using Vactor equipment from the Kaneohe yard).

3. Intensify inspection and enforcement of compliance with various CCH, DOH, and other government and private (e.g. ELRA) regulations and permits.

4. As noted by Krock & Fujioka (op. cit.), "raw sewage represents the greatest health hazard to the community. Thus, emphasis should be placed on preventing the discharge of raw sewage into environmental waters, especially inland waters that are in close association with people."

5. Initiate legislation, rulemaking, and administrative practices to intensify regulatory controls on pollutant sources and polluting activities.[15]

6. Expand the City SMA jurisdiction to include additional undeveloped and developing areas that affect coastal ecosystem and water quality and the achievement of CZM objectives.[16]

7. Continue vegetation management efforts (mangrove removal, algae removal, revegetation with native species) and intensify wildlife management efforts, including control of non-endangered and non-native bird populations and enhancement of endangered waterbird habitat.

8. Intensify public education and technical and financial assistance to landowners, land operators, households, businesses, and other watershed partners about how to reduce pollutant loads, improve water quality, and restore ecosystem integrity.

9. Liberalize the EPA interpretation of Clean Water Act §319 funding availability for retrofits to existing MS4s.[17]

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[14] The mechanical sweeping equipment is prone to repairs and the need varies. Mechanical sweeping is effective in areas with curb and gutter and not very effective in unimproved sidewalk areas and those areas with rolled curbs or areas with parked cars.

[15] Particularly with regard to NPDES MS4 permit conditions mandating post-construction Best Management Practices and the implementation of Waste Load Allocations assigned through the TMDL process. Also, CCH-DFM currently has draft rules out for review that potentially could be used to modify their maintenance practices (DFM Title 14 online at www.honolulu.gov/dfm/adminrules.pdf).

[16] The current SMA area includes the entire shoreline, Hamakua canal/Hamakua Marsh/Puuoehu, Kaelepulu canal below the confluence with Hamakua canal, and the slopes of Kaiwa Ridge. It does not include upslope areas above Kaelepulu pond that have been the site of ongoing grading activity and polluted runoff concerns.

[17] EPA Region 9 is now reconsidering DOH's proposed use of this funding to retrofit those portions of MS4s that were constructed prior to the implementation of the MS4 rule in 1990 (fund retrofits to "existing development" as opposed to "redevelopment" or "new development").

10. Reduce the amount of polluted runoff delivered to Kaelepulu pond from State and private lands in the Conservation District that are co-mingled with or independent of MS4s.

11. Increase the flux of fresh/brackish water through the estuary system via dry-weather flow augmentation, enhanced clearing of the sandbar, and/or maintenance dredging.

(5) Potential solutions that could be implemented, with consideration for the mixed ownership and control of various portions of this integrated estuary and ocean system by the state, county, and federal governments and private entities

(a) Waterbird Recovery

One of the most prominent water quality and natural resource considerations within the Kailua Bay watersheds is the conservation of federally-endangered waterbirds within the core and supporting wetlands identified in the U.S. Fish and Wildlife Service Recovery Plan for these species (draft at ecos.fws.gov/docs/recovery_plans/2005/050824.pdf). Although no critical habitat has been designated for this recovery effort, Kawainui Marsh ("core wetland" for recovery) and Hamakua Marsh ("supporting wetland" for recovery), by virtue of their designation as State Conservation District Protected Subzone and State Wildlife Sanctuary, respectively, are Class 1. inland waters. According to State water quality standards, "Any conduct which results in a demonstrable increase in levels of point or nonpoint source contamination in class 1 waters is prohibited" [HAR 11-54-3(b)(1)].

These two areas are also designated as "wetlands of international importance" under the Ramsar Convention on Wetlands (see "Kawainui and Hamakua Marsh Complex" site information sheet at www.wetlands.org/reports/infosheet.cfm?siteref=4US022). The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (www.ramsar.org) to which the U.S. is a contracting party (www.fws.gov/international/ramsar/ramsar.htm). Water-quality related measures for waterbird recovery in Hamakua Marsh identified in the Ramsar documentation include removing grazing animals from the adjacent slopes and increasing water availability in the wetlands.

Among the other two Kailua wetlands identified in the Hawaii Waterbird Recovery Plan, Nuupia Ponds on MCBH is also a "core" site that "must be protected and managed to recover Hawai`i's waterbirds," while privately-owned Kaelepulu Pond, like Hamakua Marsh, is a "supporting" site "where there is room for some flexibility in which sites must be managed, and it is possible that other sites may fulfill the same needs as those listed here." However, the Kaelepulu site is under the control of a federal Clean Water Act wetland mitigation action regulated by the U.S. Army Corps of Engineers and must conform to the terms of that agreement (perpetual preservation and maintenance of the 5.8-acre wetland area). Reducing flooding and sedimentation, improving water circulation, and removing and excluding invasive plants and animals seem to be the most important measures for waterbird recovery at this site (www.kaelepuluwetland.com).

(b) Public Trust and Public Uses

As part of their public trusteeship of natural and cultural resources, State government and its political subdivisions are obligated under Article 12, section 7 of the State Constitution (www.hawaii.gov/lrb/con/conart12.html) to "protect all rights, customarily and traditionally exercised for subsistence, cultural, and religious purposes and possessed by ahupua'a tenants who are descendants of native Hawaiians who inhabited the Hawaiian islands prior to 1978, subject to the right of the State to regulate such rights." Thus the protection of these rights as exercised in inland and marine waters throughout the Kailua Bay area is another prominent water quality and natural resource consideration. Marine waters in Kailua Bay also support federal endangered species (green sea turtle and monk seal), and are heavily used by all sectors of the population for recreational, subsistence, commercial, and cultural purposes.

The DOH objective for these Class A marine waters (in Kailua Bay and statewide) is "that their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection of fish, shellfish, and wildlife, and with recreation in and on these waters" [HAR §11-54-3(c)(2)]. The diligence with which DOH and other government agencies must protect these uses is reinforced by recent State of Hawaii Supreme Court decisions[18]. Thus DOH pursues these objectives and protects these uses through a host of environmental health programs aimed at pollution prevention and control in all environmental media. The principal DOH mechanisms for assuring water quality in all surface waters are the enforcement of conditions in NPDES permits and Water Quality Certifications, the achievement of Hawaii's Implementation Plan for Polluted Runoff Control, and the implementation of Hawaii's Coastal Nonpoint Pollution Control Program Management Plan and the Clean Water Revolving Fund Intended Use Plan, all in service to the water quality standards. The TMDL process develops a technically-based plan to achieve water quality standards that specifies how these mechanisms must be applied for particular waterbodies.

Other agencies with responsibilities and authorities in and around marine waters include the U.S. Department of the Army (DA), U.S. Department of Commerce (USDOC), U.S. Environmental Protection Agency (EPA), State Department of Land and Natural Resources (DLNR), State Office of Hawaiian Affairs (OHA), State Department of Business Economic Development and Tourism (DBEDT), and the City and County of Honolulu (CCH), as shown in the table below (**Agencies with responsibilities and authorities in and around marine waters**). There do not appear to be any DLNR, OHA, CZM, or CCH plans or objectives specifically related to aquatic resources and public uses in *Kailua open coastal waters*. However, DA requirements, the Conservation District Use Permitting Process (DLNR), CZM, and CCH functions, along with DOH water pollution control and water quality management functions, exert most of the available control over the impacts to these resources and uses.

[18] For example, DOH… must take the initiative in considering, protecting, and advancing public rights in the resource at every stage of the planning and decision-making process [*Kelly v. 1250 Oceanside Ptnrs*, 111 Hawaii 205, 231 (2006)]. Specifically, the public trust compels the state duly to consider the cumulative impact … on trust purposes and to implement reasonable measures to mitigate this impact … [*In Re Water Use Permit Applications*, 94 Hawaii 97, 143 (2000)].

In conjunction with watershed planning efforts funded by DOH, KBAC recently recommended the formation of a Kailua Watershed Council to seek acknowledgment from the Kailua Neighborhood Board (elected CCH advisory body) as a lead community entity in the planning process of watershed restoration and natural resource management. The formation of such a Watershed Council, and its relationship with the ORMP-driven Aha Moku Council, may provide a forum for developing cross-agency plans and objectives specifically related to aquatic resources and public uses in *Kailua open coastal waters.*

Agencies with responsibilities and authorities in and around marine waters
(entries in *italics* also pertain to inland waters)

Agency	Division	Function
DA	*Corps of Engineers*	*Regulate work in, over, or affecting waters of the U.S. (Rivers & Harbors Act, Clean Water Act)*
USDOC	National Marine Fisheries Service (NMFS)	Threatened and Endangered Species Recovery
	National Oceanic and Atmospheric Administration (NOAA)	*Coastal Nonpoint Pollution Program*
USEPA	*Region 9*	Water Quality Standards (recreational criteria beyond 1000' from shoreline); *Coastal Nonpoint Pollution Program*
DLNR	*Aquatic Resources*	*Aquatic Resource Management, including Threatened and Endangered Species*
	Forestry and Wildlife	State Seabird Sanctuary Management
	Boating and Ocean Recreation	Regulate Ocean Access and Recreational Activities
	Historic Preservation	*Cultural and Historic Resource Management*
	Conservation and Resource Enforcement	*Enforcement*
	Office of Conservation and Coastal Lands (OCCL)	Shoreline Protection; Beach Nourishment; Leasing of ocean waters and submerged lands and other *Conservation District Use Permitting*
OHA	*Native Rights, Land, and Culture*	Financial interest in leasing of ocean waters and submerged lands; *protect traditional and customary rights*
DBEDT	*Office of Planning, Coastal Zone Management Program (CZM)*	*Coastal Nonpoint Pollution Program; Special Management Area Program (SMA); ORMP*
CCH	*Department of Planning and Permitting (DPP)*	*Land Use, Zoning, and Site Development approvals; co-permittee for NPDES MS4*
	County Council	*SMA approvals*
	Department of Parks and Recreation	*Management of Kailua Beach Park*
	Department of Environmental Services	*Environmental quality of wastewater and stormwater system operations (NPDES permittee)*
	Department of Design & Construction	*co-permittee for NPDES MS4; designs drainageways for CCH projects*
	Department of Facilities Maintenance	*co-permittee for NPDES MS4; maintains MS4 and clears stream mouth*

Unlike marine waters, inland waters also fall within the jurisdiction of the State Commission on Water Resource Management (CWRM) and the State Water Code, which declares State policies (HRS §174C-2) to obtain maximum beneficial use of the waters of the State for numerous purposes (which don't seem to include drainage, sedimentation, flood control, or pollutant loading) and to conform with the intentions and plans of the counties in terms of land use planning (which could seem to include them). "However," according to this section, "adequate provision shall be made for the protection of traditional and customary Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and

scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation.[19]

The Water Code also requires an instream use protection program designed to protect, enhance, and reestablish, where practicable, beneficial instream uses of water in the State [§174C-5(3)]). The establishment and implementation of instream flow standards (§HRS 174C-71) and of permitting programs in designated water management areas (where resources are threatened)[20] are key parts of this program. Several beneficial uses of stream water that are to be protected by these standards are prominent concerns in the *Kaelepulu* and *Kawainui inland watersheds*, such as maintenance of fish and wildlife habitats; outdoor recreational activities; maintenance of ecosystems such as estuaries, wetlands, and stream vegetation; aesthetic values such as waterfalls and scenic waterways; maintenance of water quality; and the protection of traditional and customary Hawaiian rights. Thus there are intrinsic linkages between instream flow standards (IFS), pollutant load allocations (TMDL process), and the achievement of water quality goals.[21]

Except for a short "Urban" segment at the estuary mouth, Kaelepulu canal and Kaelepulu pond are entirely within the State Conservation District (General Subzone) (See Figure 2 – Kaelepulu Inland Watershed Conservation District Subzones and Special Management Areas). Most of the land underlying the canal is publicly owned (CCH), while the land underlying a short segment at the head of the canal, and all of the pond, is privately owned (see Figure 3 – Kaelepulu Inland Watershed Land Ownership and Public Facilities). The headwaters of Hamakua canal, which are within a 600 acre State-owned parcel occupied by Kawainui Marsh, are also within the State Conservation District (Protected Subzone). A middle section of the canal is within a 23 acres State-owned parcel occupied by the Wildlife Sanctuary, also within the Conservation District. The downstream end of Hamakua Canal, except for a short segment at its confluence with Kaelepulu canal (where it is within the Conservation District), is owned by CCH and lies within the State Urban Land Use District. While current land use district regulations focus on reactively

[19] In addition, the Code "shall be liberally interpreted to protect and improve the quality of waters of the State and provide that no substance be discharged into such waters without first receiving the necessary treatment or other corrective action." A broad interpretation of this policy could serve to provide the Commission with water quality powers, duties, and functions that may extend beyond those assigned to DOH. Also, the Code allows DOH to ban the importation of any substances DOH believes may present a danger to the water quality of the State (HRS 174C-68), a power that is not afforded to DOH by its own enabling statutes (HRS 342D AND 342E).

[20] Under HRS §174C-45(2), criteria to be considered in determining resource status include "Whether the diversions of stream waters are reducing the capacity of the stream to assimilate pollutants to an extent which adversely affects public health or existing instream uses."

[21] For example, the IFS and TMDL processes could be integrated to reevaluate the current and potential distribution of streamflows, pollutant loads, and beneficial uses within the *Kaelepulu* and *Kawainui inland* watersheds. Although flood management functions and the protection of ocean water quality are not explicitly included in the Code's beneficial uses of stream water, they could conceivable fall under the caveat of "including but not limited to."

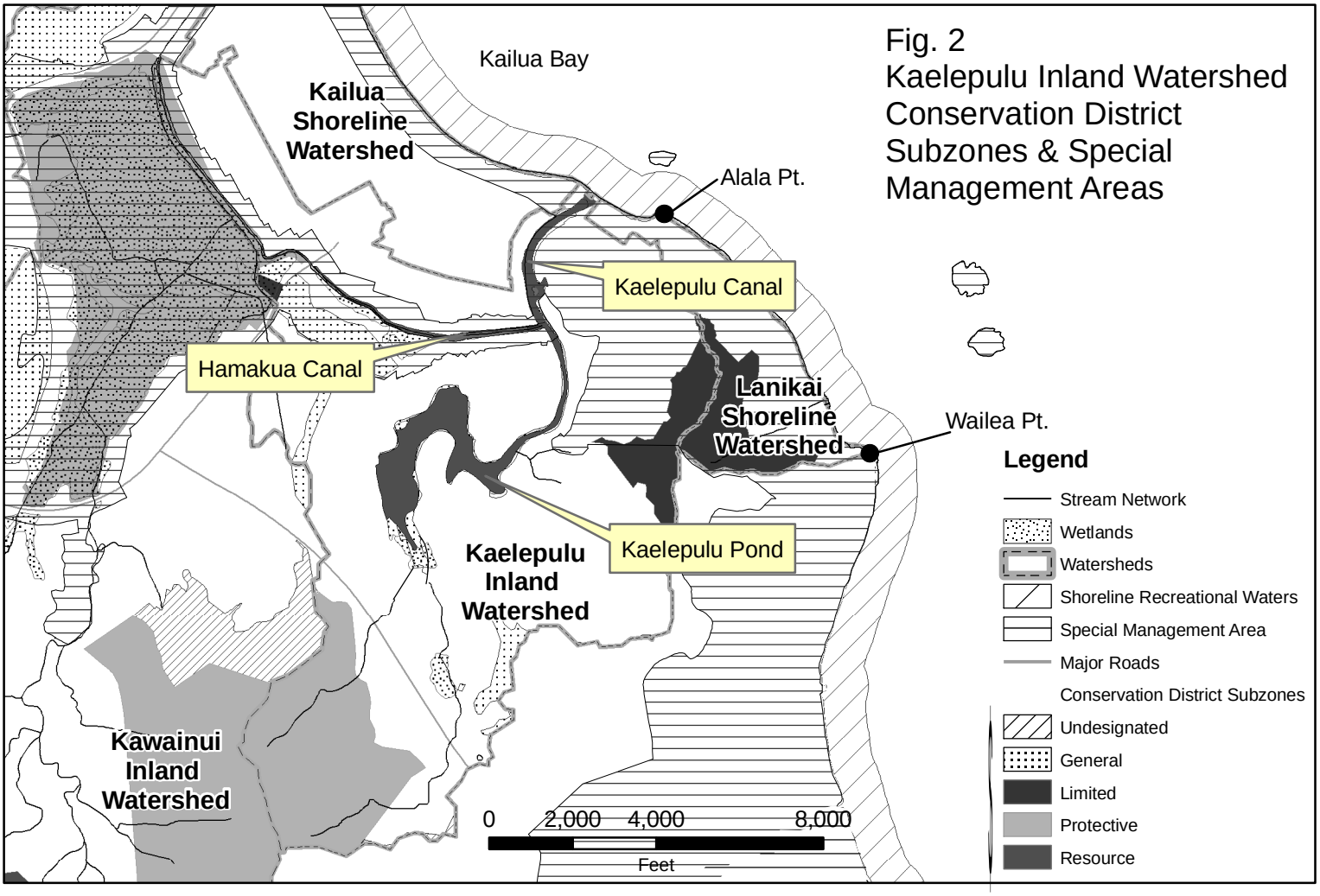

Fig. 2
Kaelepulu Inland Watershed
Conservation District
Subzones & Special
Management Areas

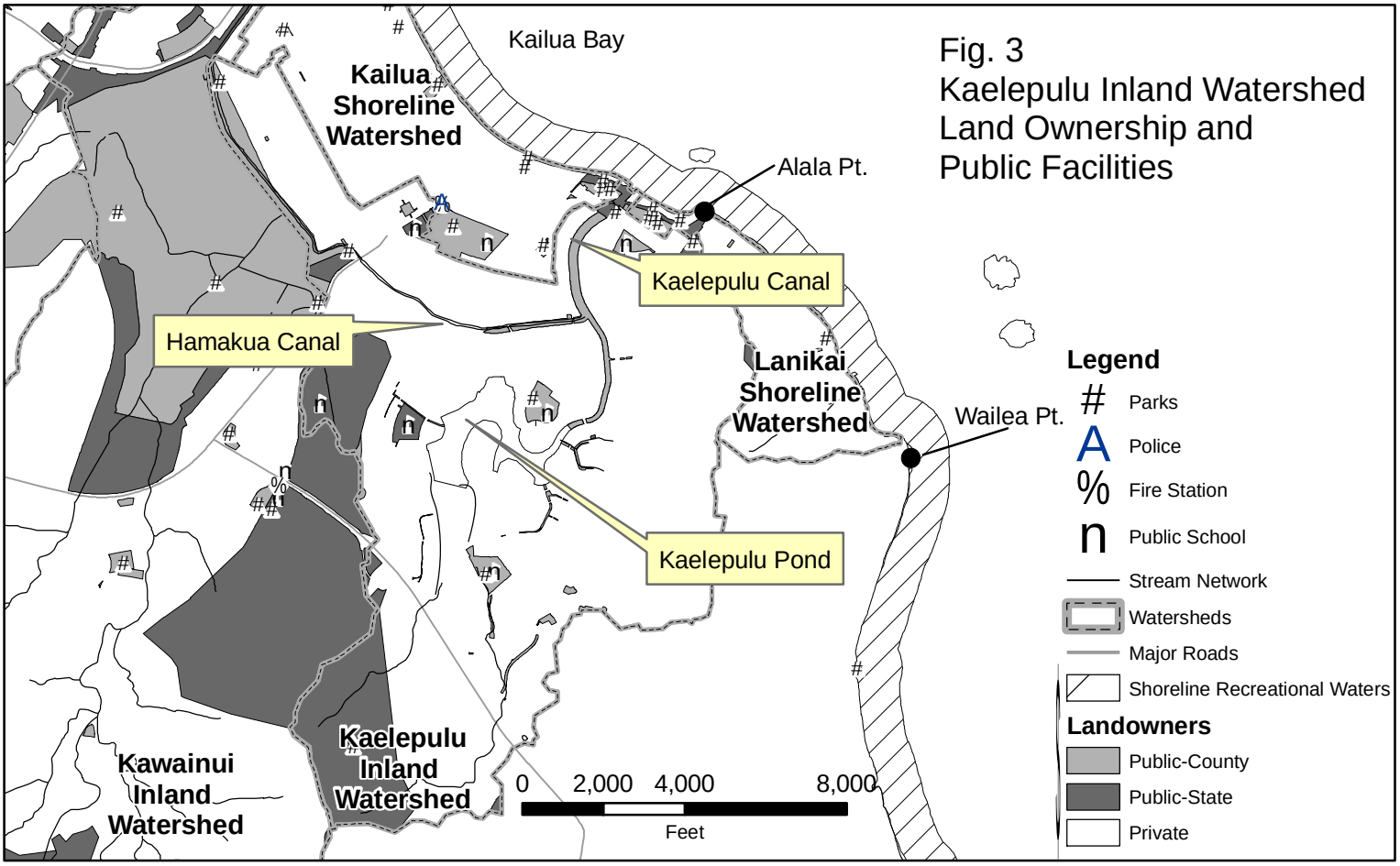

Fig. 3
Kaelepulu Inland Watershed
Land Ownership and
Public Facilities

regulating the uses proposed on these lands[22] (including placement of solid material, grading, dredging, and construction), more proactive regulation of conservation district lands, permitted uses, and nonconforming uses might be another avenue for protecting water quality in the Kaelepulu estuary system and Kailua Bay.

Agencies with responsibilities and authorities in and around inland waters

Agency	Division	Function
FEMA	Federal Insurance and Mitigation Administration	National Flood Insurance Program
USDOC	National Oceanic and Atmospheric Administration (NOAA)	Coastal Nonpoint Pollution Program
USDOI	Fish and Wildlife Service	Threatened and endangered species (waterbird recovery)
DLNR	Commission on Water Resource Management (CWRM)	Instream flow standards; Stream channel alteration;
	Aquatic Resources	Aquatic Resource Management
	Forestry and Wildlife	Forest and Wildlife Resource Management, including State lands in Kawainui Marsh, Hamakua Marsh, and Mount Olomana
	Historic Preservation	Cultural and Historic Resource Management
	Conservation and Resource Enforcement	Enforcement
	Engineering	Flood Management (HRS 179)
	Office of Conservation and Coastal Lands (OCCL)	Regulating Conservation District Uses
OHA	Native Rights, Land, and Culture	Protecting traditional and customary rights
DBEDT	Office of Planning, Coastal Zone Management Program (CZM)	Coastal Nonpoint Pollution Program; Special Management Area Program (SMA); ORMP
CCH	Facilities Maintenance Department, Road Maintenance Division	Maintain drainageways on public and private property (HRS 46-11.5); co-permittee for NPDES MS4
	Department of Planning and Permitting	Land use planning and approvals (SMA); co-permittee for NPDES MS4
	Department of Design & Construction	co-permittee for NPDES MS4; designs drainageways for CCH projects
	Department of Environmental Services	Environmental quality of wastewater and stormwater system operations (NPDES permittee)
	County Council	SMA approvals
	Department of Parks and Recreation	Management of Kailua Beach Park

[22] According to HAR §13-5-14, the objective of the General Subzone "is to designate open space where specific conservation uses may not be defined, but where urban use would be premature." The land uses allowed in this subzone and in the Protected Subzone include those "undertaken by the State of Hawaii or the counties to fulfill a mandated governmental function, activity, or service for public benefit and in accordance with public policy and the purpose of the conservation district" (HAR §13-5-22). However, "Erosion control, flood control, and other hazard prevention devices and facilities" are allowed in the General Subzone (HAR §13-5-23), not in the Protected Subzone, and both types of uses require permits from the Board of Land and Natural Resources (BLNR). While the status of current use of the estuary system as a sink for pollutants and a floodwater storage and conveyance facility may be unclear [are they "permitted uses" or "nonconforming uses" (that don't require permits due to their establishment immediately prior to October 1, 1964, or prior to the inclusion of the land within the conservation district, §HAR 13-5-2)?], any future change in these existing uses could trigger review and revised regulation under the BLNR's Conservation District Use permitting process.

(c) Flooding

The existence of a DA flood control project in the *Kaelepulu* and *Kawainui inland watersheds* complicates the implications of any water transfers between the two watersheds and of any dry-weather flow augmentation in Kaelepulu. While the protective aspects of flood management are largely regulated, engineered, and maintained by the DA, Federal Emergency Management Agency (FEMA), DLNR (www.hidlnr.org/eng/nfip), and CCH, the water quality impacts of flood management are the joint responsibility of these and many other agencies, particularly DA, DOH, CWRM, and CCH. Optimizing the relationship between flood protection and water quality is an ongoing challenge, exacerbated by our modern history of neglect for and abandonment of the protective functions of riparian corridors and floodplains. Although in-depth analysis of this relationship is beyond the scope of this report, factors to consider in overcoming these challenges include DA and CWRM's reluctance to assert jurisdictional authority over the construction of flood management structures in intermittent streams; the lack of enforceable biological criteria for stream and estuary habitat in DOH water quality standards; the corollary lack of biologically-sensitive design requirements in CWRM's stream channel alteration permits (SCAP) and in most floodway designs; and the difficulty of changing entrenched channel maintenance procedures that are locked in a self-perpetuating feedback loop with antiquated floodway designs, and that focus on clearing accumulated sediment and removing intrusive vegetation rather than on managing waterways as biological systems.

(d) Land and Water Management

In addition to previously referenced documents, a wide assortment of land and water management policies and plans are available to guide management decisions and human activities that may have beneficial water quality effects. These include but are not limited to:

- Hawaii Water Plan
www.hawaii.gov/dlnr/cwrm/planning/hwp.htm

- Hawaii's Comprehensive Wildlife Conservation Strategy
www.state.hi.us/dlnr/dofaw/cwcs/index.html

- Interim State of Hawaii Strategic Plan for Invasive Species Prevention, Control, Research and Public Outreach
www.state.hi.us/dlnr/dofaw/HISC/HISC%20Documents/Interim%20Invasive%20Species%20Strategic%20Plan.pdf

- State of Hawaii Aquatic Invasive Species Management Plan
www.hawaii.gov/dlnr/dar/pubs/ais_mgmt_plan_final.pdf

- DOFAW management guidelines
www.state.hi.us/dlnr/dofaw/guidelines/mg_jw03/index.html

- Hawaii Tropical Forest Recovery Action Plan
www.hawaii.gov/dlnr/dofaw/pubs/HITropicalForestRecoveryPlan.pdf

- Integrated Natural Resource Management Plan for Marine Corps Base Hawaii

(e) Conclusion

Many potential solutions could be implemented to improve the water quality and natural resources of the estuary system and its impact on state beaches and waters in Kailua Bay. The solutions we select depend upon the goals we establish for the long-term future of the water environment. Under present conditions, Kaelepulu is filling-in with sediment and will eventually change from a predominantly open water environment to a predominantly wetland environment. Some of the solutions promoted to date imply a goal of slowing or reversing this in-filling. However, this goal has not been clearly established throughout the current network of landowners, public water quality and natural resource trustees, and other public and private interests.

Clear goals for Kaelepulu are obscured by the size and scope of this stakeholder network; the regional context of the surrounding Kailua area (including Lanikai, Kawainui, and Mokapu); and overlapping jurisdictions and competing objectives for land use, water use, environmental quality, and flood management. Therefore, establishing long-term goals and implementing appropriate solutions may best fall under the umbrella of the Hawaii Ocean Resources Management Plan (ORMP, State Office of Planning). To chart a new course for resource management and help reverse the consequences of our previous actions, this plan adopts an area-based approach implemented by a broad base of stakeholders, rather than sector-based approaches implemented by jurisdictional entities. Elements of this approach that may be particularly useful in Kaelepulu include addressing all resources in an integrated manner that considers cumulative impacts, and adopting regulations that are adapted to area or ecosystem management priorities.

Coordinated legislative, executive, and community action will be needed to conduct this planning process, implement the selected solutions, and achieve the established goals. Key elements of this coordination may include a wide range of existing authorities and functions within federal, State, and City government, particularly the Hawaii Water Code and Water Plan (State Commission on Water Resource Management); Flood Control, Conservation District Use Regulation, and Forestry and Wildlife Management (State Department of Land and Natural Resources); the CCH Development Plan, Koolaupoko Sustainable Communities Plan, and related municipal approvals, permits, and requirements (especially Special Management Area; Drainage, Flood, and Pollution Control; Grading, Grubbing, and Stockpiling: and Maintenance of Channels); and the Koolaupoko Watershed Restoration Action Strategy and a future Kaelepulu Total Maximum Daily Load Implementation Plan (State Department of Health).
In addition to the ORMP framework, it may be useful to note one other coordinating mechanism enabled by State environmental law. Under HRS §341-4, “the director of the Office of Environmental Quality Control shall have such powers delegated by the governor as are necessary to coordinate and, when requested by the governor, to direct pursuant to chapter 91 all state governmental agencies in matters concerning environmental quality.”